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# EUROPEAN PATENT APPLICATION

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64 Improved vehicle door and a method for its assembly.

67 The door (1) comprises a frame (2) and an outer panel (5) disposed in such a manner as to close a compartment (3) defined by the frame (2) and containing the mobile window pane (4) with its operating means; the panel (5) is hinged to the frame (2), and this latter is hinged to the vehicle body so

that, having painted said structure together with the body, the compartment (3) can be opened by rotating the panel (5) on its hinges, and the window pane (4) and its operating means mounted; the compartment (3) is then re-closed and the panel (5) fixed securely to the frame (2).

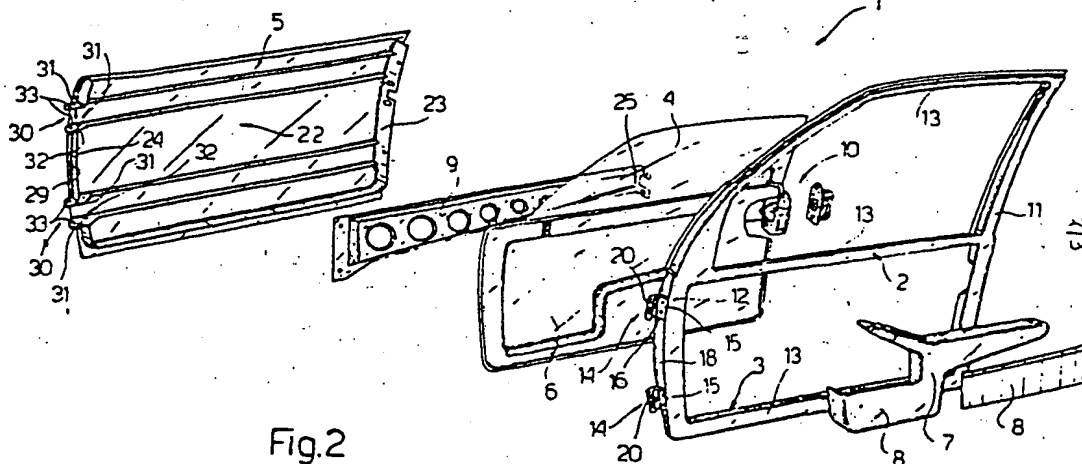


Fig. 2

## IMPROVED VEHICLE DOOR AND A METHOD FOR ITS ASSEMBLY

This invention relates to an improved vehicle door formed in such a manner as to facilitate its assembly by making it more rapid and economical, and a method for mounting said door on a vehicle body.

5 Vehicle doors are normally formed from a load-bearing frame defining internally a compartment for housing the mobile window pane and the devices which operate the door and said window pane, and from an outer covering panel welded to the load-bearing frame and disposed

10 so that it closes said compartment. These two elements, already in an assembled state, are mounted on the body and painted together therewith. On the vehicle assembly line, operating personnel then assemble the mobile window pane and other said auxiliary devices in said compartment through suitable apertures provided in the inside

15 of the door, these then being closed by a finishing panel.

Known doors therefore require relatively lengthy and difficult assembly operations to be carried out, and compel the operator to often work blindly through small-dimension apertures and passages, while mostly following the body as it moves along the assembly line. Under these

20 conditions it is apparent that it is impossible to carry out automatic assembly in the case of known doors, and that any maintenance on the door structure or mechanisms contained in said compartment is difficult.

An object of the present invention is to provide a door of the known

25 type, which ensures easy and rapid access to the compartment by using the mobile window pane and auxiliary devices, so as to make both their assembly and subsequent maintenance easy and rapid.

A further object of the invention is to provide an assembly method for said door which enables automatic devices such as robotised assembly lines to be used should this be desirable.

Said objects are attained according to the present invention by a  
5 vehicle door of the type comprising a frame defining internally a compartment for housing both a mobile window pane and the mechanical door devices, means for supporting said window pane and mechanical devices, and an outer covering panel disposed so as to close said compartment, characterised in that one end of said outer covering  
10 panel is connected to said frame by a hinge device, this latter being arranged to enable the outer covering panel to rotate relative to the frame at least through an angular arc of width sufficient to make said compartment accessible from the outside.

The invention also relates to a method for mounting a door on a  
15 vehicle, characterised by comprising the following stages:

- hinging to the vehicle body a load-bearing frame internally defining a compartment, and hinging one end of an outer covering panel to the load-bearing frame in such a manner as to close said compartment;
- painting the structure thus obtained together with the body;
- 20 - rotating the outer panel on its hinges relative to the frame in order to make said compartment accessible from the outside;
- mounting a mobile window pane and the necessary mechanical devices inside the compartment;
- closing said compartment by rotating said outer panel on its hinges  
25 in the opposite direction; and
- securely locking said outer panel to the load-bearing frame.

The present invention will be more apparent from the non-limiting

d scripti n f two embodiments thereof given hereinafter with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of a door constructed in accordance with the present invention;

5 Figure 2 is an exploded perspective view of the door of Figure 1;

Figure 3 is a section on the line III-III of a portion of the door of Figure 1; and

Figure 4 shows the same section through the same detail as Figure 3, but of a possible modification of the door of the invention.

10 In Figures 1 and 2, the reference numeral 1 indicates overall a door for a vehicle of any known type, for example a motor vehicle, comprising a load-bearing frame 2 defining internally a compartment 3 for housing a descending window pane 4 and respective known mechanical operating devices, not shown for simplicity, for the window pane and  
15 door, and an outer covering panel 5 which is disposed on the outside of said door 1 such that when the door 1 is mounted it closes the compartment 3. The door 1 also comprises a finishing panel 6 provided with respective inner arm rests 7 and respective object-carrying pockets 8, an inner stiffening cross-member 9 fixed to the frame 2  
20 and contained in the compartment 3 for supporting the window pane 4 and said known mechanical devices, and a lock 10 fixed in a position corresponding with a rear upright 11 of the frame 2, preferably at the cross-member 9.

In the illustrated non-limiting example, the frame 2 comprises in  
25 addition to the rear upright 11 a respective front upright 12 and respective connecting cross-members 13, which upperly define a window aperture to be closed by the descending window pane 4, and lowerly

define said housing compartment 3 which when the door 1 is mounted is closed on the inside of the door by the finishing panel 6 and on the outside by the covering panel 5. This latter is constructed, as is the frame 2, from suitable metal plate which is blanked, bent and welded together in known manner, or can be constructed by moulding a suitable plastics material, and is preferably of such dimensions and shape as to engage with the lower part of the frame 2 to close the compartment 3, so that the window aperture in the door 1 is defined only by the upper part of the frame 2.

According to the invention, the upright 12 is provided with a pair of respective hinges 14 arranged to allow the frame 2 to be hinged to the body, not shown for simplicity, of any vehicle of any known type, also not shown for simplicity. According to the invention, the hinges 4 are defined by a pair of substantially L-shaped brackets 15 fixed rigidly, for example by suitable screws 16, to the front wall 18 of the upright 12, to project frontwards from this latter. With reference also to Figure 3, that end 19 of the brackets 15 which is opposite that fixed to the wall 18 projects to a predetermined distance from the upright 12 and is provided with a transverse through bore 20 having its axis substantially vertical and arranged to hold, when the door 1 is mounted, a respective hinge pin 21 of any known type. Preferably the ends 19 of the brackets 15 are of forked configuration in order to facilitate the introduction and withdrawal of the pins 21 and to allow engagement with the body hinges.

On the same side as its inner surface 22 which faces the compartment 3, the outer panel 5 is provided, in positions corresponding with the uprights 11 and 12, with respective projecting transverse ribs,

indicated by 23 and 24 respectively, formed in a position parallel and adjacent to the corresponding uprights 11 and 12 and arranged to cooperate with these latter to define therewith, for example, suitable labyrinth seals in order to seal the compartment 3 in a substantially dust-tight manner. The rear rib 23 is formed preferably perpendicular to the surface 22 and is arranged for secure fixing, by suitable locking means such as screws and/or pins, to the upright 11 and to one end 25 of the cross-member 9. The rib 24 according to the illustrated non-limiting example is also disposed substantially perpendicular to the surface 22 and is formed parallel and adjacent to the upright 12 in a position facing an oblique wall 28 of this latter which is adjacent to the wall 18 and to the ends 19 of the corresponding brackets 15 fixed to this latter.

The rib 24 is provided in a position corresponding with the front end 29 of the panel 5, this end being provided with a further pair of hinges 30 which enable the panel to be hinged to the frame 2, and which when the door 1 has been mounted extend further beyond the upright 12, towards which the end 29 is bounded by the rib 24 itself, which thus provides lateral closing of the compartment 3. The hinges 30 are provided preferably in a position corresponding to that occupied by the hinges 14, and are each defined by a respective pair of projecting lugs 31 formed rigid with the panel 5 and preferably integral with the rib 24, relative to which they project perpendicularly from the opposite end to the rear rib 23. In a preferred embodiment of the invention, the hinges 14 and 30 defined by the brackets 15 and lugs 31 have their respective axes of rotation coaxial and coincident, in that the lugs 31 define between themselves two respective seats



32 in which, when the door 1 is mounted, the corresponding ends 19 of the brackets 15 are received, and which are provided, in positions corresponding with the bores 20, with respective through bores 33 coaxial with the bores 20 and arranged for idle engagement by the said pin 21, which is thus simultaneously able to hinge the panel 5 to the frame 2, and to hinge this latter and thus the entire door 1 to said body, not shown, of any vehicle of known type.

The door 1 can be assembled in the following manner: when the construction of the frame 2 and panel 5 has been completed by known methods on the sheet metal lines, the brackets 15 are fixed to the upright 12 in a suitable position so as to enable them to be inserted into the seats 32, after which the panel 5 is disposed on the frame 2 in such a manner as to close the compartment 3, by mounting the ribs 23 and 24 over the uprights 12 and 13 being careful to insert the brackets 15 into the seats 32 between the corresponding pairs of lugs 31. The structure obtained in this manner is then securely assembled by hinging the frame 2 and panel 5 together, and simultaneously hinging these to the body of the vehicle on which the door 1 is to be mounted, by simply placing the hinges 14 and 13, coupled in the aforesaid manner, in positions corresponding with the hinges carried by the vehicle body, and then inserting the pins 21 through the bores 20 and 33. When the pins 21 have been inserted, they determine both the said hinging of the panel 5 to the frame 2 and the said hinging of both of these to the vehicle body. The structure thus obtained, when mounted on the body, can be painted together with it by processes of known type, possibly keeping the panel 5 rotated from its closed position in order to facilitate entry of the paint into

the compartment 3, after which it is conveyed to the assembly line. The window pane 4, its support members and said mechanical operating devices for the window pane 4 and door 1, such as the window regulator, its drive motor, the transmission linkages for the lock 10 and the like, are fixed on the cross-member 9 simultaneously in a suitable assembly station, using automatic machines. The finishing panel 6 with the possible control switch for the window regulator and the internal part of the lock 10 is also preassembled on the cross-member 9. The external part of the lock 10 is mounted directly on the frame 2 against the upright 11, so that the structure formed by the frame 2 and panel 5 can be kept closed against the body in order to prevent damage during transportation along the assembly line. Finally, an operator or robotised machine rotates the panel 5 relative to the frame 2 on the pin 21 in the direction of the arrow shown in Figure 3, in order to open the outer structure of the door 1 in the manner of a book, so making the compartment 3 accessible from the outside, he then inserting thereinto, by means of a single operation, the preassembled sub-unit constituted by the cross-member 9, the window pane 4, the said mechanical devices and the finishing panel 6. When inserted into the compartment 3, said sub-unit remains housed therein and the panel 6 closes the compartment 3 on the inside of the door. Finally, the cross-member 9 is fixed to the frame 2 for example by suitable screws, and the gasket which surrounds the window pane is then mounted thereon, after which, having rotated the panel 5 in the opposite direction until it closes the compartment 3, said panel 5 is fixed to the frame 2, by fixing the rib 23 to the upright 11 using screws, pins or other locking devices. All the described

operations can be carried out without moving the frame 2, which remains closed against the vehicle body, by virtue of the presence of the oblique wall 28 on the upright 12, which enables the panel 5 to be rotated relative to the frame 2 while preventing any interference between the rib 24 and upright 12 during the rotation of the panel 5. Any accidental movement of the frame 2 is prevented by premounting the external part of the lock 10 thereon. It is apparent from the described procedure that the operations involved in mounting the door 1 on the assembly line are reduced simply to the opening and closure of the panel 5 and the mounting of the window pane surround gasket and the insertion of an already preassembled unit into the compartment 3.

Figure 4 shows a possible modification of that detail of the door 1 shown in Figure 3. All details similar or equal to those already described are indicated by the same reference numerals for simplicity. In particular, according to the modification of Figure 4, the front wall 18 of the upright 12 lacks the adjacent wall 28, and is disposed obliquely to the inner surface 22 of the panel 5. The front end 29 of this latter is bounded not by the rib 24 but by a rib 40 which projects obliquely from the inner surface 22 and, when the door 1 is mounted, is disposed directly in contact with the oblique wall 18 instead of only in a position facing and adjacent to this latter, as in the case of the rib 24 described heretofore. In this manner, as the rib 40 and wall 18 of the upright 12 are in close contact with each other, the compartment 3 is sealed in a dust-tight manner, thus improving the protection thereof compared with the embodiment of Figure 3. In order to enable the panel 5 to be hinge-rotated relative

to the frame 2, the lugs 31 projecting from the end 29, and which define the hinges 30, are provided, in positions corresponding with the bores 20, with respective slots 41 which are substantially of L-shape and pass through said lugs 31, instead of the corresponding bores for housing the pin 21 which are shown in the embodiment of Figure 3. The opposite ends of the slots 41 are rounded to substantially the same dimensions as the bores 20 so that they can idly engage the pins 21. In order to open the compartment 3, it is firstly necessary to push the panel 5 in the direction of the arrow before commencing its rotation, in order to distance it from the upright 12. In doing this, the pins 20 are moved inside the slots 41 from one end to the other thereof, so causing the wall 18 to withdraw from the rib 40 by a distance sufficient to enable the panel 5, when pulled in a direction such as to withdraw it from the frame 2, to rotate relative to the frame 2 in a manner analogous to that heretofore described.

The advantages attainable with the present invention are apparent. All the operations involved in assembling the door can be carried out automatically and with extreme rapidity and ease, and painting of the compartment 3 is facilitated. Maintenance of the devices housed in the compartment 3 is also enormously facilitated, in that it is necessary only to disengage the rib 23 from the upright 11 to be able, even after assembly, to rotate the panel 5 relative to the frame 2 and thus make the compartment 3 accessible from the outside. Finally, it is apparent that should the panel 5 become damaged by impact, it can be replaced without having to replace the entire door 1, with consequent considerable saving for the user.

Finally, it is apparent that modifications can be made to the described  
structure and method of assembly, without leaving the scope of the present  
invention.

## PATENT CLAIMS

1. A vehicle door (1) of the type comprising a frame (2) defining internally a compartment (3) for housing a mobile window pane (4) and the mechanical door devices, means for supporting said window pane (4) and mechanical devices, and an outer covering panel (5) disposed so as to close said compartment (3), characterised in that one end (29) of said outer covering panel (5) is connected to said frame (2) by means of a hinge device (14, 30, 21), this latter being arranged to enable the outer covering panel (5) to rotate relative to the frame (2) at least through an angular arc of width sufficient to make said compartment (3) accessible from the outside.
2. A door (1) as claimed in claim 1, characterised by comprising respective first hinges (14) carried by an upright (12) of said frame (2), and respective second hinges (30) carried by said end (29) of the covering panel (5), said first hinges (14) being arranged to connect the door (1) to a vehicle body, and said second hinges (30) connecting said covering panel (5) to said frame (2).
3. A door (1) as claimed in claim 2, characterised in that said second hinges (30) are carried by the front end (29) of said outer covering panel (5), and which is disposed adjacent to the front upright (12) of said frame (2), this latter upright being provided with said first hinges (14).
4. A door (1) as claimed in claim 2 or 3, characterised in that said first and second hinges (14, 30) have their respective axes of rotation coaxial and coincident.
5. A door (1) as claimed in one of claims 2 to 4, characterised in that that end (29) of the outer covering panel (5) provided with

said hinges (30) is disposed so that it projects beyond said upright (12) and is bound towards this latter by a rib (24, 40) which is arranged to cooperate with said upright (12) in order to provide lateral closure of said compartment (3), and is provided on the same side of said panel (5) as its inner surface (22) which faces said compartment (3).

6. A door (1) as claimed in claim 5, characterised in that said rib (24) is substantially perpendicular to said inner surface (22) of said panel (5), and is formed parallel and adjacent to said upright (12) in a position facing an oblique wall (28) of this latter, said hinge device comprising two pairs of respective projecting lugs (31) formed rigidly with said outer panel (5) and defining said second hinges (30), a pair of respective brackets (15) substantially of L shape and fixed rigidly to said upright (12) of said frame (2), said brackets (15) defining said first hinges (14), and further comprising a pin (21) connecting the outer panel (5) to the frame (2) and housed idly in respective coaxial bores (20, 33) provided through said brackets (15) and said lugs (31), these latter defining respective seats (32) in which said brackets (15) are housed.

7. A door (1) as claimed in claim 5, characterised in that said rib (40) projects obliquely from said inner surface (22) of the panel (5) and is disposed in contact against a corresponding oblique wall (1b) of said upright (12), said hinge device comprising two pairs of respective projecting lugs (31) formed rigidly with said outer panel (5) and defining said second hinges (30), a pair of respective brackets (15) substantially of L shape and fixed rigidly to said upright (12) of the frame (2), said brackets (15) defining said first hinges (14), and further comprising a pin (21) which connects the outer panel 5

and frame (2) together and is idly housed in respective through bores (20) provided through said L-shaped brackets (15) and in respective substantially L-shaped slots (41) provided through said projecting lugs (31).

5 8. A door (1) as claimed in any one of the preceding claims, characterised by further comprising a finishing panel (6) bounding said compartment (3) on the inside of the door, a stiffening cross-member (9) mounted inside said compartment (3) and arranged to carry said window pane (4) and mechanical devices, and fixing means for  
10 securely locking said outer covering panel (5) to said frame (2) in such a manner as to close said compartment (3).

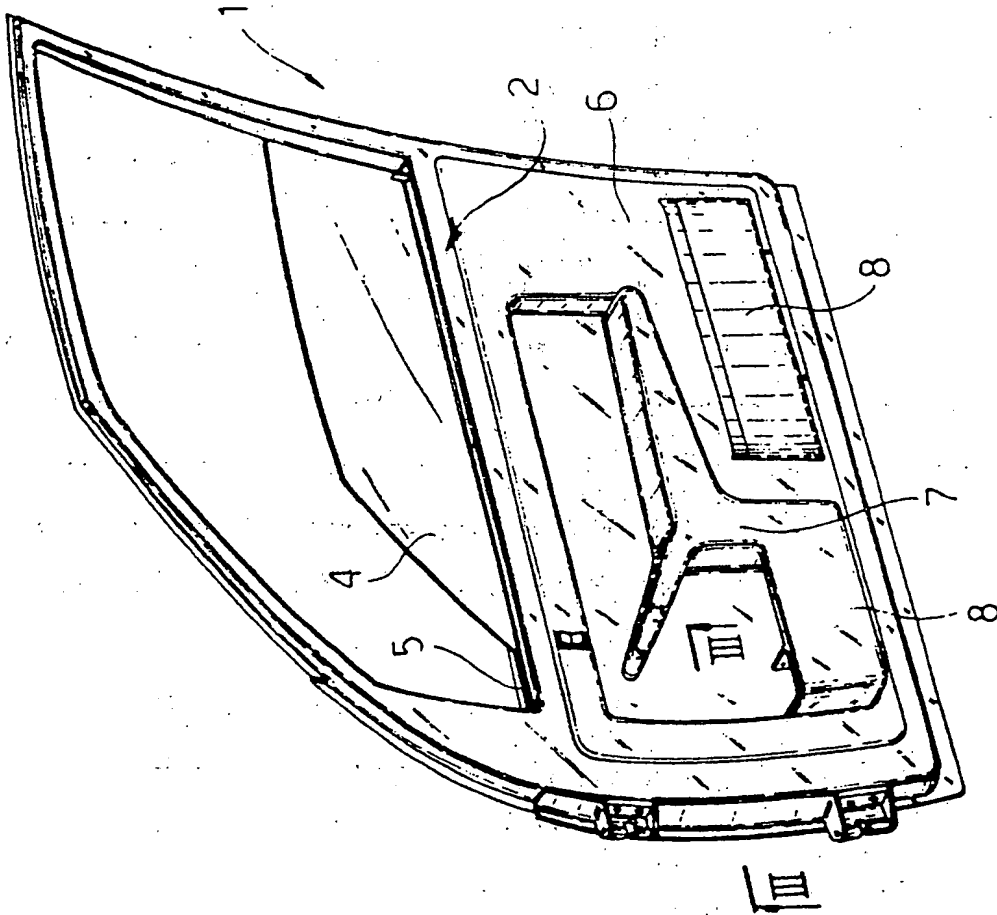
9. A method for mounting a door on a vehicle, characterised by comprising the following stages:

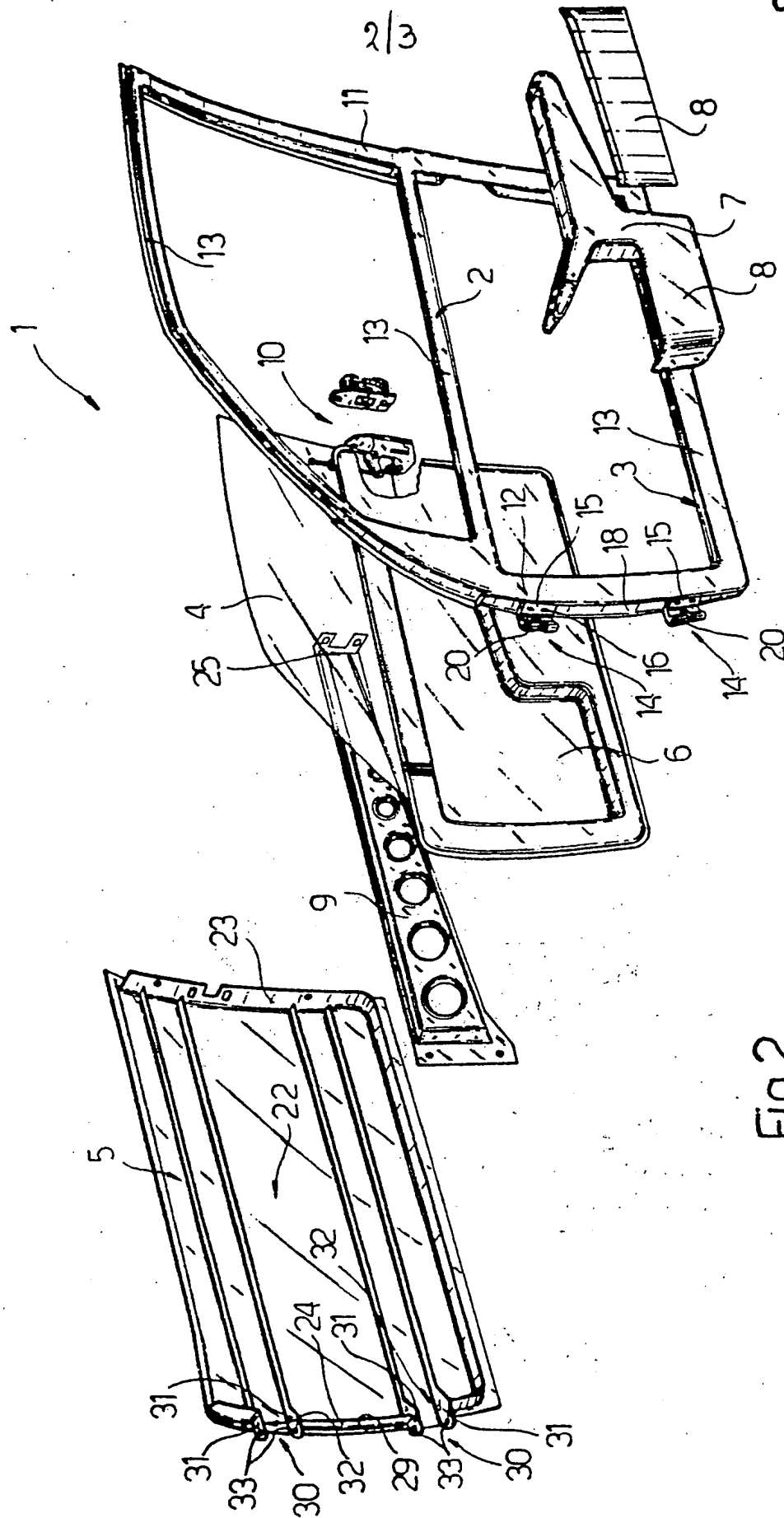
- hinging to the vehicle body a load-bearing frame (2) internally  
15 defining a compartment (3), and hinging one end (29) of an outer covering panel (5) to the load-bearing frame (2) in such a manner as to close said compartment (3);
- painting the structure thus obtained together with the body;
- rotating the outer panel (5) on its hinge relative to the frame  
20 (2) in order to make said compartment (3) accessible from the outside;
- mounting a mobile window pane (4) and the necessary mechanical devices inside the compartment;
- closing said compartment (3) by rotating said outer panel (5) on its hinges in the opposite direction; and
- 25 - securely locking said outer panel to the load-bearing frame (2).



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Fig.1





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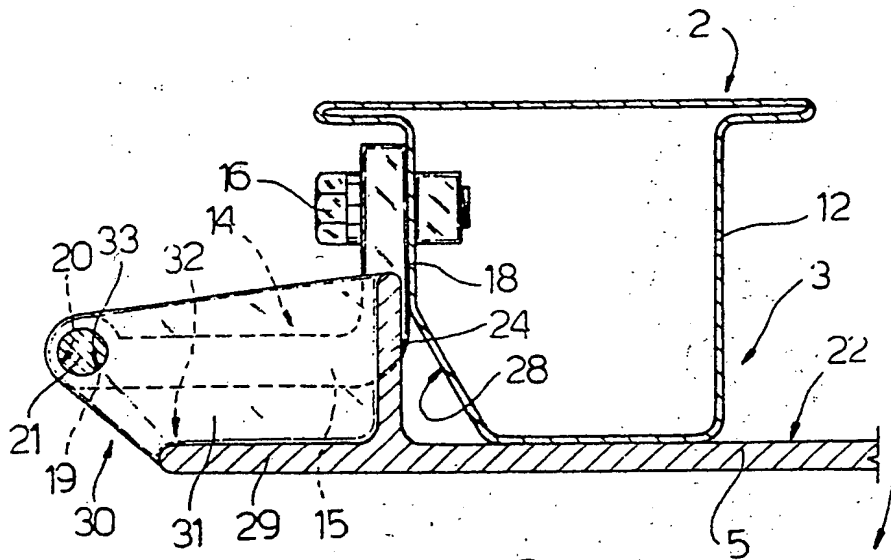


Fig. 3

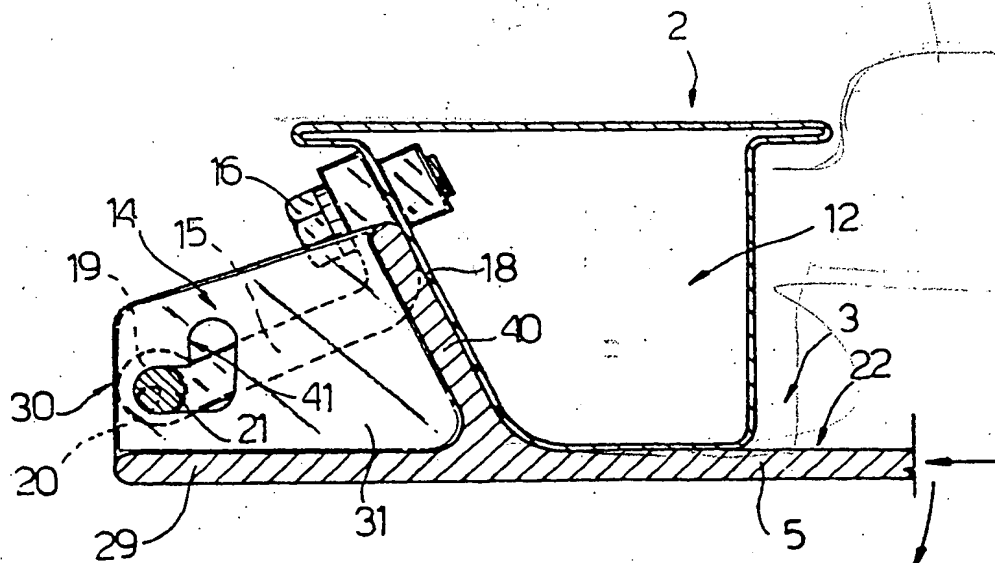


Fig. 4



DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 4)
A	FR-A-2 236 678 (AVRIL) * Page 3, lines 39 - page 4, line 3; figures 6,8 *	1	B 60 J 5/04
A	FR-A- 849 640 (GORALSKI) * Page 1, line 62 - page 2, line 17; figures 1-46 *	1	
A	FR-A- 597 115 (BAEHR) * Page 2, lines 91-98; figure 8 *	1	
A	US-A-2 134 487 (LEVINSON) * Page 1, left-hand column, line 55 - right-hand column, line 51; figures 3-5 *	1	
A	PATENTS ABSTRACTS OF JAPAN, vol. 8, no. 185 (M-323) [1632], 7th September 1984; & JP - A - 59 84 622 (NISSAN JIDOSHA K.K.) 16-05-1984	1	TECHNICAL FIELDS SEARCHED (Int. Cl. 4)  B 60 J 5 B 62 D 25 B 62 D 65
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 15-10-1985	Examiner AYITER I.
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